

Fine Needle Aspiration Cytological study of Bone tumors and tumor like lesions with clinic pathological correlation

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Abstract: Back Ground: Fine Needle aspiration Cytology (FNAC) is a minimally invasive and highly effective primary diagnostic method adopted worldwide to establish diagnosis. Application of FNAC in osseous neoplasm is limited as it requires a thorough understanding of histologic complexity and non-specific nature of varied cell morphologies commonly seen in bone tumors. In present study its role in the diagnosis of metastatic lesions has been stressed.

Aims: The study is to establish the accuracy of the procedure as compared to the histopathology and the role of cytological study as a compliment to histopathology.

Material and Methods: In the present three year study 42 cases of FNAC of bone lesions were done. Collected from department of orthopedics, Guntur General Hospital, Guntur. Cytological study was made and most of the cases were correlated with histopathology.

Results: A total number of 42 aspirations were done 39 aspirations were neoplastic and 3 were non neoplastic. Successful aspirations were 38 and unsatisfactory aspiration were 4. FNAC and biopsy correlation of secondary deposits is 100%.

Conclusion: With detailed clinical data, radio graphical data and analysis FNAC can be accurate in most of the lesions. FNAC can be of great help in differentiating between primary and secondary tumors.

Key words: Bone tumors, FNAC, Histopathological correlation, Metastatic lesions, Primary

I. Introduction

Fine needle aspiration cytology (FNAC) is a minimally invasive and highly effective primary diagnostic method practiced world wide for accurate diagnosis of various pathological lesions. Dr. Stanley performed the first FNAC in 1833 at St. Bathomews Hospital London. Application of FNAC in osseous neoplasms is limited. High percentage of inadequate samples and non specific results in the diagnosis of primary bone tumors had made it a controversy. However in our present study its role as a primary investigation method in the diagnosis of metastatic bone lesions has been stressed. It is important to realize that the final diagnosis of bone tumors should be made based on combined evaluation of clinical data, age of the patient, site of lesion, radiological findings and microscopic findings.

II. Material And Methods

Total 42 cases were collected in three year study from department of orthopedics, Guntur General Hospital, Guntur. During this study each case was assessed in detail taking clinical history, radiological findings etc.

Cytological study was made and most of the cases were correlated with histopathology. All were stained with hematoxylin and eosin and one case with PAS stain.

III. Results

A total number of 42 aspirations were done. 39 aspirations were neoplastic and 3 were non – neoplastic. 29 cases of the 42 aspirations were suggestive of malignant lesions. 9 were reported as benign lesions and 4 smears were inconclusive as they showed only blood cellular elements. Out of 30 malignant lesions 18 (58%) were primary tumors 12 (41%) were secondary deposits. The three non-neo plastic lesions turned out to be Aneurysmal bone cysts.

Secondary deposits are observed to be a common occurrence among bone tumors. 12 cases were reported in our series of which 8 (66.6%) cases were due to adeno carcinoma 3 (25%) cases were squamous cell carcinoma, and 2 (16.6%) case were follicular carcinoma thyroid.

Among the primary tumors five cases of osteogenic sarcoma, four cases of chondrosarcoma and two cases of synovial sarcoma were reported.

Three cases of giant cell tumor involving long bones and three cases of Aneurysmal bone cyst involving short bones were seen.

Results of the present study

Total Number of cases	42	
Successful aspirations		38
Unsatisfactory aspirations	04	
Number of Benign tumours		09
Number of Malignant tumours	30	
Number of tumour like lesions	03	

Table – I

Total Number of tumours:	42	
Total Number of Primary tumours:	30	71.4%
Total Number of Malignant tumours:	18	42.8%
Total Number of Benign tumours:	09	21.4%
Total Number of tumour like lesions:	03	03%
Total Number of Secondary tumours:	12	28.5%

Table – II Shows incidence of each histological type

S. No.	Tumors	Nos.	% age
01.	Osteochondroma	1	2.3%
02.	Osteoblastoma	1	2.3%
03.	Osteogenic sarcoma	5	11.9%
04.	Chondroblastoma	1	2.3%
05.	Chondromyxoid Fibroma	1	2.3%
06.	Chondrosarcoma	4	9.5%
07.	Giant cell tumor	3	7.1%
08.	Ewings sarcoma	6	14.2%
09.	Synovial sarcoma	2	4.7%
10.	Giant cell reparative Granuloma	1	2.5%
11.	Cemento ossifying fibroma	1	2.3%
12.	Multiple Myeloma	1	2.3%
13.	Aneurysmal Bone cyst	3	7.1%
14.	Secondaries	12	28.5%
	Total	42	

Table III Frequency Distribution of Cases According Age and Sex

S.No.	Tumors	0-10 Yrs		11-20 Yrs		21-30 Yrs		31-40 Yrs		41-50 Yrs		51-60 Yrs		61-70 Yrs		Total
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	
01.	Osteochondroma	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
02.	Osteoblastoma	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
03.	Osteosarcoma	-	1	2	1	1	-	-	-	-	-	-	-	-	-	5
04.	Chondroblastoma	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
05.	Chondromyxoid Fibroma	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
06.	Chondro Sarcoma	-	-	-	1	-	1	-	-	-	1	-	1	-	-	4
07.	Giant cell tumor	-	-	-	-	1	1	1	-	-	-	-	-	-	-	3
08.	Giant cell reparative Granuloma	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
09.	Ewings Sarcoma	-	1	4	1	-	-	-	-	-	-	-	-	-	-	6
10.	Synovial Sarcoma	-	1	-	-	-	-	-	1	-	-	-	-	-	-	2
11.	Cemento ossifying	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
12.	Multiple myeloma	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
13.	Aneurysmal bone cyst	-	-	1	-	1	-	1	-	-	-	-	-	-	-	3
14.	Secondaries	-	-	-	-	-	1	2	1	3	1	2	1	-	1	12
15.	Total	-	4	8	4	5	3	5	2	3	2	2	3	-	1	42

Table IV Frequency Distribution of Cases as per site

S.No	Tumors	Il	F e	Ti	Fi	Hu	Ra	Ul	SbH	Sk	Sc	Rib	Jaw	Total
01.	Osteochondroma	-	-	1	-	-	-	-	-	-	-	-	-	1
02.	Osteoblastoma	-	-	1	-	-	-	-	-	-	-	-	-	1
03.	Osteosarcoma	-	1	4	-	-	-	-	-	-	-	-	-	5

04.	Chondroblastoma	-	1	-	-	-	-	-	-	-	-	-	-	1
05.	Chondromyxoid fibroma	-	-	-	1	-	-	-	-	-	-	-	-	1
06.	Chondro Sarcoma	1	-	-	-	2	-	-	-	1	-	-	-	4
07.	Giant cell tumor	-	-	1	-	1	-	1	-	-	-	-	-	3
08.	Giant cell reparative Granuloma		-	-	-	-	-	-	-	-	-	-	1	1
09.	Ewings Sarcoma	1	1	-	1	-	-	-	1	1	-	-	1	6
10.	Synovial Sarcoma	1	-	1	-	-	-	-	-	-	-	-	-	2
11.	Cemento ossifying Fibroma	-	-	1	-	-	-	-	-	-	-	-	-	1
12.	Multiple myeloma	-	-	-	-	-	-	-	-	-	-	1	-	1
13.	Aneurysmal bone cyst	-	1	-	-	-	-	-	2	-	-	-	-	3
14.	Secondaries	1	2	1	-	1	1	4	4	-	2	-	-	12
15.	Total	4	6	9	2	4	1	5	7	2	2	1	3	42

Il – Ileum, Fe – Femur, Ti – Tibia, Fi – Fibula, Hu – Humerus, Ra – Radius
 Ul – Ulna, SbH – Small bones of Hand, Sk – Skull, Sc – Scapula

Table V FNAC and Biopsy Correlation of Present study

No.	Cytological Diagnosis	No.	Cytological Diagnosis	Histological Diagnosis	No.
01.	Osteochondroma	01	Osteochondroma	Osteochondroma	1
02.	Osteoblastoma	01	Blood cellular elements	Osteoblastoma	1
03.	Osteosarcoma	05	Osteosarcoma - 04 Inadequate smear - 01	Osteosarcoma	5
04.	Giant cell tumor	03	Giant cell tumor	Giant cell tumor	3
05.	Chondroblastoma	01	Benign cartilaginous lesion	Chondroblastoma	1
06.	Chondrosarcoma	04	Chondrosarcoma	Chondrosarcoma	4
07.	Synovial sarcoma	02	Sarcoma - 01 Synovial sarcoma - 01	Synovial sarcoma	2
08.	Marrow tumors		Ewings sarcoma – 04 PNET - 02 Multiple Myeloma	Ewings sarcoma Multiple myeloma	6 1
09.	Giant cell reparative Granuloma	01	Giant cell reparative granuloma	Giant cell reparative granuloma	1
10.	Chondromyxoid fibroma	01	Blood cellular elements	Chondromyxoid fibroma	1
11.	Cemento ossifying fibroma	01	Ameloblastoma	Cemento ossifying fibroma	1
12.	Aneurysmal Bone cyst	03	Diagnosed - 02 Blood cellular elements -01	Aneurysmal Bone cyst	3

Table VI FNAC and Biopsy Correlation of secondary deposit

S.No	Type of Tumor	No.	Cytological Diagnosis	Histological Diagnosis
01.	Follicular carcinoma of thyroid	05	Follicular carcinoma of thyroid	
02.	Adenocarcinoma	06	Papillary adeno Carcinoma 02 Mucin secreting Adeno carcinoma 01 Adeno carcinoma 03	Adeno carcinoma deposit 02
03.	Squamous cell Carcinoma	03	Poorly differentiated Carcinoma 01 Squamous cell Carcinoma 02	Squamous cell Carcinoma 01

Success rate in Various bone Tumors

Type of Tumors	No.cases	Positive Cases	Percentage
Benign	12 cases	9	74.9%
Malignant	18 cases	17	94.4%
Secondaries	12 cases		100 %

IV. Discussion

Initially conceived as a screening procedure with the advent of fine needle aspiration biopsy, today cytology is considered to be one of the reliable diagnostic procedure in bone tumors.

Reasonable diagnosis by needle aspiration requires is teamwork of orthopedic surgeon, radiologist and pathologist with a clear understating of the purpose of aspiration for each individual case and also its limitations. The primary objective of FNAC is to differentiate malignant or benign mesenchymal tumors and to diagnose secondary deposit.

In the present study total 42 cases were studied. Of these 42 cases 4 cases didn't yield sufficient cellularity (9.5%). Out of 42 cases 30 (71.4%) were malignant (including both Primary and Secondary bone lesions) and 12. (28.5%) were benign lesions (including tumor like lesions of the bone). Among the primary tumors we encountered 20% of the bone forming tumors and 23.3% of cartilage forming tumors.

Osteochondroma – One Case of Osteochondroma has been reported with an incidence of 2.3% of total cases and an incidence of 8.3% of all benign lesions. A male patient aged 12 years presented with a small swelling of size 3 cms in the upper end of tibia.

On FNAC smears showed myxoid background with cartilaginous Cells and osteoblasts. It was reported as Osteochondroma, which was confirmed by histopathological examination.

According to Ackerman & Huvos osteochondromas are most common benign tumor of bone representing 50% of benign neoplasms and 10 to 15% of all Primary tumours. Silverberg described 35.8 to 45% of benign tumors mostly seen in patients younger than 21 years (2,20,38).

Osteoblastoma – According to Silverberg and Orell the smears show spindle celled fragments, scattered osteoblasts, and benign multinucleated cells (38,40). One case of Osteoblastoma has been reported with an incidence of 2.3% of all bone tumors and 8.3% of all benign tumors. A male patient aged 24 years presented with swelling lower end of femur. FNAC smears showed only blood cellular elements and the case was diagnosed as Osteoblastoma by histopathological examination.

According to Huvos it represents 1% of all primary bone tumors. Silverberg series – 1 to 4% with significant male predominance. The age range is 5 to 78 years. With most common occurrence in the 2nd and 3rd decades. According to study by F.M.Cheung, W.C.Wu, C.K.Lam & Y.K.FU it is a rare benign tumor with an incidence of 0.8% to 17 of all primary bone tumors (2,38,10).

Osteosarcoma – Conventional osteosarcoma – According to Jennifer A. Young, Orell, Silverberg smears show pleomorphic malignant cells round, spindle shaped and polygonal cells, multinucleated giant cells, mitoses with atypical mitotic figures and tumor Osteoid (18,38,40).

Telengiactatic Osteosarcoma – Blood and necrotic debris comprise the back ground with above cellular features. Osteoid exceedingly scant or absent(38).

5 cases of Osteosarcoma were reported in the present study. It was the second most common malignant tumor observed in the present series with a frequency of 11.9% of all cases and 16.6% all malignant tumors. Age groups involved were 9 – 25 years. Of the 5 cases, 3 cases were presented in male patient and two cases in female patients. Commonest presenting symptom was swelling and pain in all the cases. Lone bones were affected in all the cases, metaphysic was the site of tumor in all the cases except one where diaphysis was involved. Three cases occurred at upper end of tibia, one case in lower end of tibia and one case shaft (lower 1/3rd) of femur. Radiographs showed sclerotic growth with lytic areas and periosteal reaction. But classic sun ray appearance was not seen.

FNA Smears show oval, irregular and spindle shaped cells with marked pleomorphism, mononucleate, binucleate and multinucleated giant cells against haemorrhagic background. Focal areas show tumor osteoid. The features are correlated with features described by above authors. So they were reported as conventional osteosarcoma (Fig. 1,2)

One case of teleniaectatic osteosarcoma showed rich blood cellular elements with similar cellular features and no clear-cut evidence of an osteoid. But the features are correlating with features described by Silverberg, we reported it as telegiaectatic osteosarcoma after correlation with radiological features and confirmed with histopathological examination.

According to study by Howard D. Dorfman and Bogdan C. Zerniak Osteosarcoma was the most frequently diagnosed primary sarcoma of bone – 35 % followed by chondrosarcoma 25.8% and Ewing's sarcoma 16% (14). Only about 8% of the osteogenic sarcomas arise in diaphysis. According to Huvos only 54 cases were reported in the diaphysis (2).

Conventional Osteosarcoma is the most common and most important Osteosarcoma with peak occurrence in 2nd decade of life and occurs most frequently in males than in females (2:1) (2,15,17,20,38). In the present series similar Sex incidence is observed.

Chondroblastoma – According to Silverberg and Orell FNAC of Chondroblastoma is characterized by cellular smears with small mononuclear cells arranged singly and in clusters with Osteoclast like giant cells and fragments of chondroid matrix. There was minimal pleomorphism of cells and mitotic activity was almost absent. Jennifer A. Young also described fragments of cartilaginous material with similar cellular features (9,18).

In the present series one case of chondroblastoma was reported with an incidence of 2.3% of all cases and 8.3% of benign tumors. Male patient of age 14 years presented with swelling of Right Knee of size 4 x 3 cm associated with pain since 1 year, no history of trauma. X-Ray revealed a lytic lesion of lower end of femur involving epiphysis.

Smears showed rich cell yield consisting of cells resembling chondroblasts, uni and binucleated cells, spindle shaped stromal elements, osteoclasts in small numbers, foreign body giant cells, myxoid areas and microspherules of calcification (Fig 3).

Chondroblastoma is a rare benign tumor accounts for 1% of bone tumors in the Mayo clinic, Even Huvos and Jaffe had given the same incidence. Mostly teenagers are affected with increased incidence in males and most common site is lower end of femur (2,17,44).

Chondro Sarcoma – According to Hajdu and Hajdu and Orell smears show large mononuclear or binucleate cells seen singly or in clusters often in myxomatous background. A typical often binucleate cells with finely vacuolated and abundant cytoplasm are seen (15,40).

According to study done by Mustafortune and Cermilekine and Silverberg low grade chondrosarcoma cells were embedded in abundant pink-purple amorphous or granular chondroid matrix occasionally resembling lacunae. Cells were found singly or in small sheets or loose aggregates. The cytoplasm was extensive, pale bluish and generally had small vacuoles and a few small, pink granules. Mitotic figures were absent. In high grade tumors chondrocytes were extremely pleomorphic. Mitotic figures were abundant. Similar features are described by Jennifer A. Young (18,34).

4 cases of Chondrosarcoma were reported in the present study with a frequency of 9.5% of all the bone tumors, 13.3% of the malignant tumors. The age incidence ranges from 19 to 60 years, three cases occurred in female patients and one case in male patient.

Smears showed Chondroid matrix, uninucleated and binucleated cells with moderate cytoplasm. In some areas cytoplasm showed vacuolation and a few tumor giant cells are seen. The features are correlated with above authors. So they were reported as Chondrosarcoma (Fig 4,5).

In second case FNAC of femur showed the similar pictures. So it was reported as Chondrosarcoma humerus with secondaries in femur.

According to Hajdu and Hajdu, Huvos, Jaffe, Ackerman and Silverberg Chondrosarcoma is the second most common primary malignant neoplasm of bone making up of an approximately 17 to 22% of all malignant bone tumors (2,15,13,20,38).

Chondromyxoid fibroma – According to Silverberg smears show fragments of Chondromyxoid matrix admixed with stellate, spindled and round cells. Binucleate and multinucleated forms may be present. Chondroblasts are also present. Orell and Jennifer A. Young described similar features (18,38,40).

A case of Chondromyxoid fibroma was reported with an incidence of 2.3% of all tumors and 8.3% of all benign tumors. A male patient of age 25 years presented with swelling over upper 1/3rd of left tibia. On FNAC smears showed only fibroblast like spindle cells and blood cellular elements and hence no conclusive opinion was given. Biopsy confirmed the diagnosis.

It is a rare benign neoplasm accounting for less than 0.5% of all primary benign bone tumors. Patients range from 3 to 70 years of age with a male predominance (2,38).

Giant cell tumor – According to Silverberg smears are highly cellular with a double cell population. Mononuclear spindle cells and Osteoclastic type of giant cells are seen. Giant cells are attached to the periphery of the clustered spindle cells. Similar features are described by Orell, Hajdu and Hajdu and Young (15,18,40).

In the present series 3 cases of giant cell tumors were reported with a frequency of 7.1% of total cases and 25% of all benign tumors. The age of incidence was 23 – 35 years. Two cases were reported in males and one case in female.

Smears from all the 3 cases showed rich cell yield with oval to spindle shaped mononuclear stromal cells and plenty of osteoclastic type of giant cells. Correlated with features described by above authors. So they were reported as giant cell tumor (Fig 6).

According to Jaffe, 75% of tumors occurred between 20-40 years of age with slight female preponderance. According to Huvos Giant cell tumor represents 5%, with an increased incidence in females. More than 80% occur in patients older than 20 years i.e, in individuals who are skeletally mature (2,14,17).

Giant cell reparative granuloma – One case of giant cell reparative granuloma was reported with an incidence of 2.3% of all tumors and 8.3% of all benign tumors. A female patient of age 14 years presented with a swelling in right maxillary region which was painless. Size of the swelling increased gradually. Variable consistency. X – ray showed lytic lesion.

Smears showed moderate cell yield with abundant multinucleated giant cells, with spindle to oval shaped stromal cells, macrophages, pigment laden macrophages, lymphocytes and a few neutrophils.

Presently it is referred to as simply giant-cell granuloma. It chiefly afflicts patients of less than 20 years twice as frequently as female patients (1,2). It involves mandible more frequently than maxilla.

Ewings Sarcoma – In 1921 James Ewing described a primary malignant tumor of bone in which he emphasized the perivascular arrangement of the tumor cells and suggested a derivation from vascular endothelium (16,35,41).

Silverberg, Orell, Hajdu and Hajdu described that tumor cells are arranged singly, in dense sheets and in loose clusters. Pseudorosettes were seen. Cells were round with scant cytoplasm and prominent nucleolus. Also seen were smaller dark cells with irregular hyperchromatic nuclei interspersed among lightly stained cells (15,38,40).

In the present series 6 cases of Ewings sarcoma were reported which was the most common primary tumor. It represents 14.2% of all cases and 20% of all malignant tumors. 5 cases were reported in males and one case in female. 3 cases were seen in long bones. One case in the angle of jaw, another case in iliac crest and last case in the dorsum of hand. X – ray of dorsum of hand showed destruction of meta carpal bone (Fig. 16) with secondaries in lung and brain (frontal lobe)

Smears showed rich cell yield. Cells are arranged in sheets, rosettes against eosinophilic fibrillary background. Two types of cells were seen (1) large cells with abundant thin poorly defined cytoplasm containing vacuoles and round or oval nuclei with finely granular chromatin and small inconspicuous nucleoli (2) small, dark cells with dense chromatin. Small dark cells were interspersed between large cells. Frequent mitotic figures were seen (Fig.7,8). The features were correlated with the description given by above authors. So the diagnosis of Ewings sarcoma was made. 2 cases out of 6 showed PAS positivity.

According to Jaffe it is not very common indeed rarer than Osteo Sarcoma or Chondro Sarcoma. Incidence by various authors Huvos – 10%, Silverberg – 5 to 6% (2,38) 80% of tumors occurred in first 2 decades with increased incidence in males. Isolated brain metastasis is distinctly uncommon, reported incidence being 1.1 – 4.3% Mehta and Hendrickson reported 5 patients 19% with CNS involvement in a series of 27 patients (8).

Plasma cell Myeloma –According to Silverberg smears show normal and abnormal plasma cells in various stages of maturation with a mixture of large mono-nuclear cells, plasma blasts and undifferentiated small mononuclear cells may also be seen. Similar features are described by Hajdu&Hajdu and Orell (15,38,40).

One case of plasma cell myeloma was reported with an incidence of 2.3% all tumors of bone and 8.3% of all malignant tumors.

A female patient aged 60 years presented with pain in the ribs. X – rays revealed multiple lytic lesions in the ribs. Skull bones show punched out lesions. Aspiration from 11th rib was done.

Smears show tightly packed neoplastic cells in discrete as well as in sheets and groups. Discrete cells showed abundant cytoplasm with pink tinge, eccentric nucleus, perinuclear halo with increased mitotic activity and cellular pleomorphism. Multinucleated cells were seen. Mature plasma cells were also seen (Fig.9). It is the most common neoplasm of bone – nearly half of all malignant neoplasms of bone.

Synovial Sarcoma - Smears from synovial sarcoma are usually highly cellular. The typical appearance is a mixture of tissue fragments and dispersed cells. Bare nuclei are common. The cells are small to medium sized. Nuclei are rounded or ovoid with finely granular, bland chromatin and nucleoli are small and inconspicuous. Mitosis can be found. Biphasic pattern is rare in authors experience (40)

According to Young biphasic synovial sarcomas yield 2 different cell populations one composed of medium sized epithelial like cells and the other spindle cells. Thin ramifying capillaries are occasionally observed. Mast cells is a common finding in both types of synovial sarcoma (18)

Two cases were reported with a frequency 4.7% of all tumors and with a frequency of 6.6% of all malignant tumors.

Smears from the 2 cases showed moderate cell yield with marked cytological pleomorphism, some resembled plump epithelial cells with rounded contour and other resembling sarcomatous cells, picture is suggestive of sarcoma. On histo pathology both the cases were diagnosed as synovial sarcoma (Fig. 10).

According to Hajdu and Hajdu Synovial Sarcoma occurring in children showed good prognosis (15). In Jaffe's series (1944) 95 cases were reported (17)

Cemento ossifying fibroma—In the literature cytological appearance of cement ossifying fibroma is not described on the aspiration smear.

One case was reported with a frequency of 2.3% of all primary tumors and frequency of 8.3% of all benign tumors. A male patient aged 32 years presented with a mandibular swelling.

Smears showed moderate cell yield with cells of epithelial nature with hyperchromatic nuclei and orderly appearance arranged in groups and some areas showed palisaded pattern. Also seen were spindle cells with scanty cytoplasm and oval nuclei.

The reasons for false positivity are 1) Grossly multiple bits received. Entire tumor was not submitted. So the biopsy site may be different from FNAC site. 2) Spindle cells and osteoclastic giant cells are seen in both the cases.

The differential diagnosis for cement ossifying fibroma is ameloblastoma(1).

Aneurysmal bone cyst – According to Silverberg smears are mostly bloody and pauci cellular. Osteoclast like giant cells, benign spindle cells are seen. Osteoblasts and osteoid are also noted. (4,18,38).

3 cases of aneurysmal bone cysts were reported with a frequency of 7.1% of all cases and 25% of all benign tumours.

In 2 cases smears showed blood cellular elements, a few macrophages, spindle shaped cells, occasional osteoclastic type of giant cells. Features are consistent with above authors description.

So they were reported as aneurysmal bone cyst. In one case smears showed only blood cellular elements. So biopsy confirmed the diagnosis.

In 238 patients with Aneurysmal bone studied in the Mayo clinic files, more than 80% of the lesions were in the long bones, flat bones or the spinal column, 95% were typical (cystic) and rest were solid variant. Ages of the patients ranged from 18 months to 69 years. Long bone lesions were most common in the femur and tibia. (4)

In Jaffe's series (1958) 35 cases were seen. They involved either shafts of long bones or vertebral column. According to Huvos it constitutes 6% of all primary bone tumors.

Secondary Deposit (2,5) – The great majority of metastatic cancerous skeletal lesions represent metastases from carcinomas. Skeleton is one of the most common sites of cancer metastasis.

A total of 12 cases of metastatic tumors were reported with an incidence of 28.4% of all tumors of bone and the age incidence ranging from 30 – 70 years. 7 cases were adeno carcinoma deposits, 3 cases were squamous cell carcinoma and 2 cases were follicular carcinoma thyroid (Fig.11,12,13).

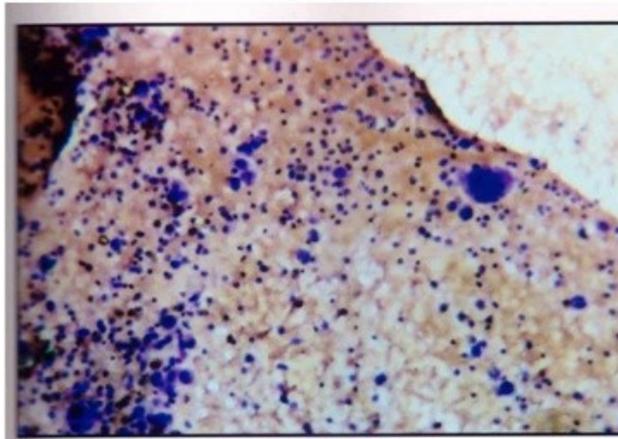
All the 12 cases showed rich cell yield. So definitive diagnosis was given and most of the patients proceeded with definitive treatment as radiotherapy basing on cytology report only.

8 cases occurred in male patients and 4 cases occurred in female patients. In adenocarcinoma the sites of involvement are skull bones, ileum, clavicle, scapula and ulna. Squamous cell carcinoma deposits occurred in scapula, femur and mandible. Follicular carcinoma of thyroid occurred in femur and scalp swelling.

A Comparison of the present study was done with previous cytodiagnosis of bone tumor series.

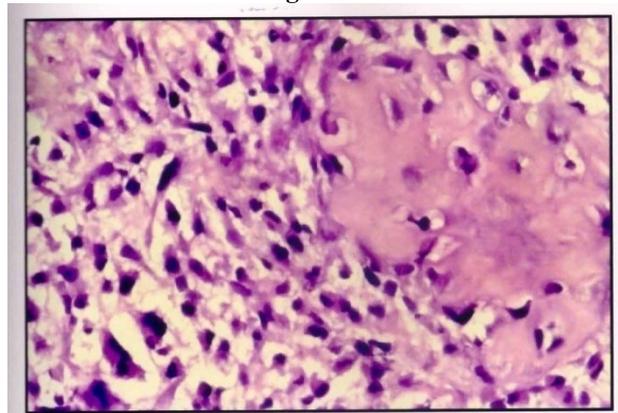
The success rate for benign tumors was 74.9%. The success rate for malignant and metastatic tumors were 94.4% and 100% respectively correlation was possible with most of previous studies. FNA will yield diagnostic material from metastatic lesions. This procedure may forestall the need for open biopsy.

Figure : 1



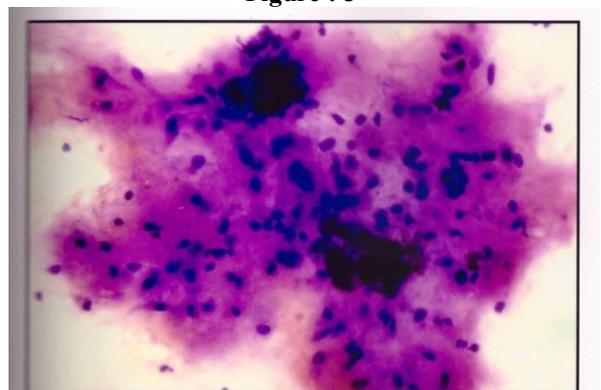
Cytological Picture of a **Osteogenic Sarcoma** showing Pleomorphic cells, tumor giant cells with Osteoid

Figure : 2



Histological Picture of a **Osteogenic Sarcoma** showing round to oval and Spindle shaped cells with tumor osteoid

Figure : 3



Cytological Picture of a **chondroblastoma** with cells resembling chondroblasts, stromal elements, giant cells and micro spherules of calcification against myxoid background

Figure : 4

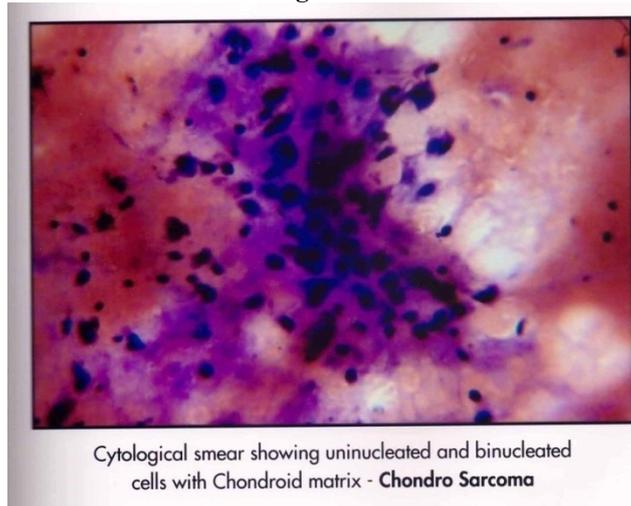


Figure :5

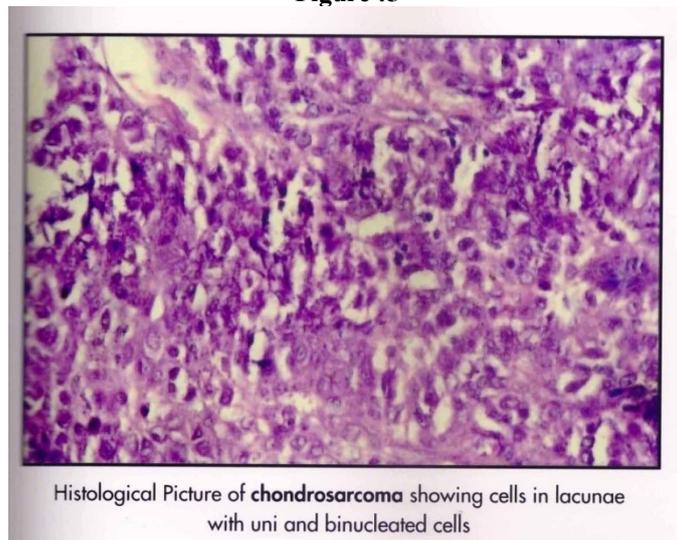


Figure : 6

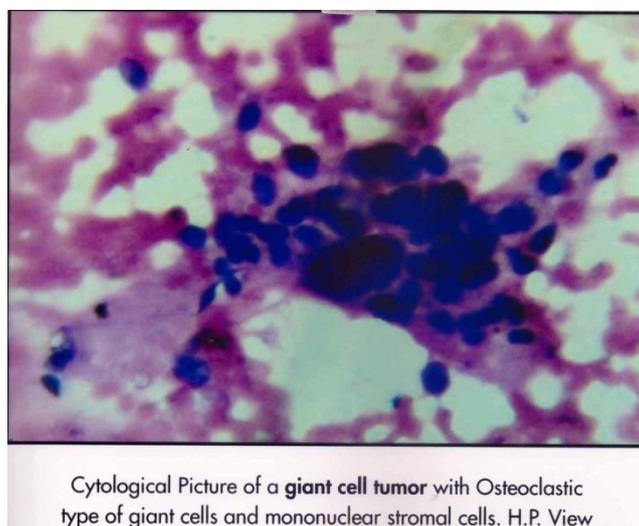


Figure :7

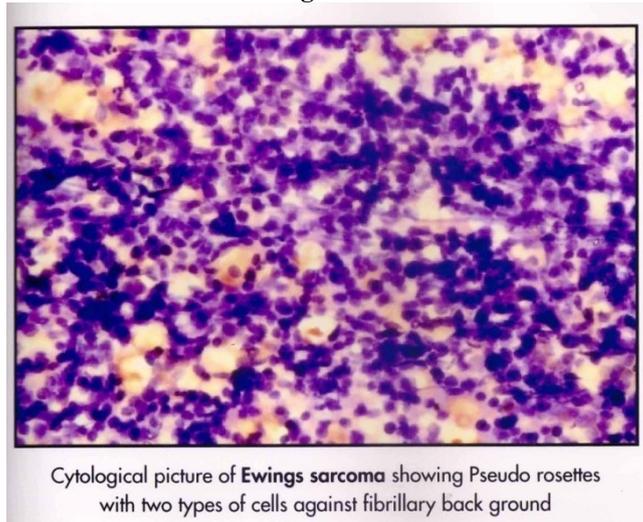


Figure : 8

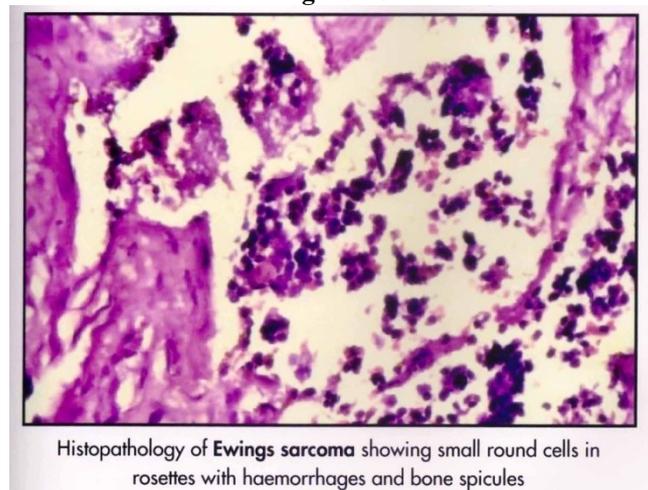


Figure : 9

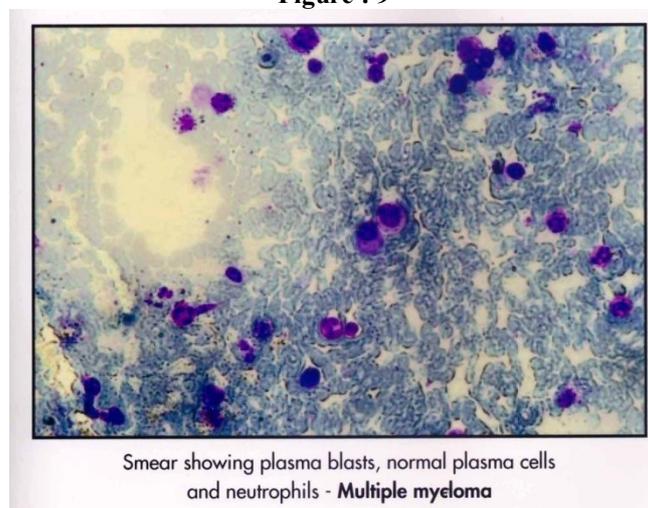
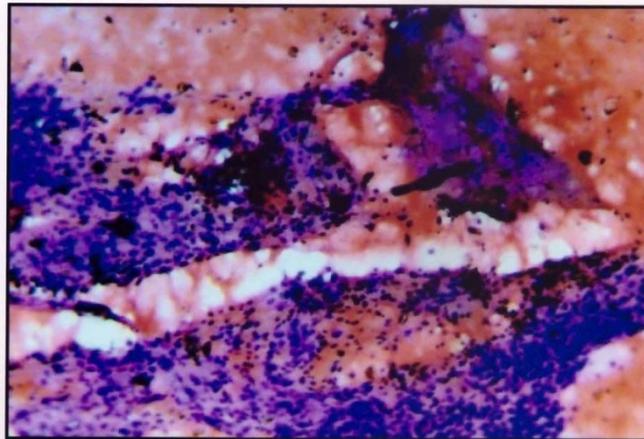
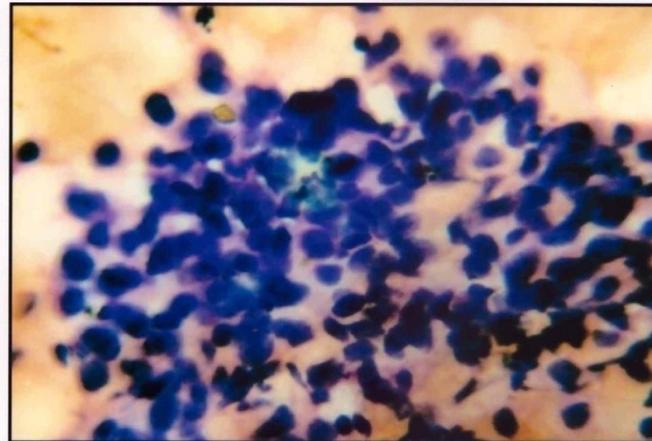


Figure : 10



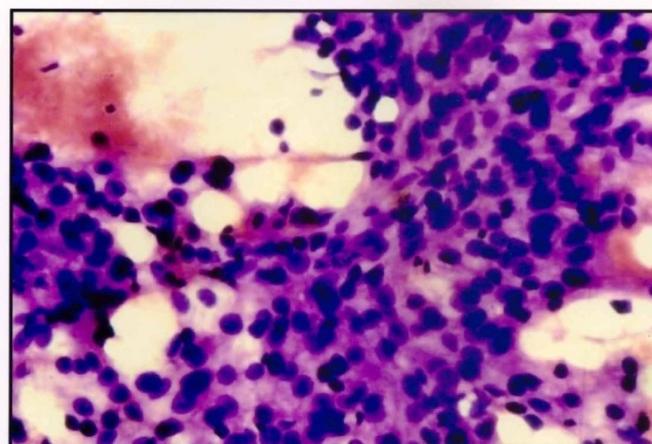
Cytological picture of **synovial sarcoma** with both spindle shaped and round to oval cells - L.P. View

Figure : 11



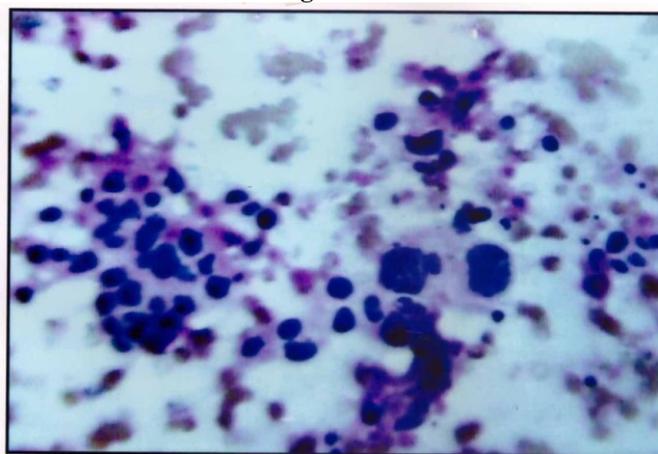
Cytological picture of **Adeno carcinoma** deposit - H.P. View

Figure : 12



Cytological picture of **Secondary deposit of follicular carcinoma thyroid** with follicles against the background of colloid admixed with haemorrhage

Figure : 13



Cytological picture of a **Squamous cell carcinoma** showing dyskeratotic cells and tumor giant cells - H.P. View

V. Summary And Conclusions

The present study included 42 cases of benign, malignant and metastatic bone tumors. Among the 42 cases, 4 cases (9.5%) did not yield sufficient cellularity on aspiration and the remaining 38 (90.4%) cases yielded sufficient cellularity for the cytological diagnosis.

Among the 42 cases 30 (71.4%) were malignant and 12 (28.5%) were benign tumors. Out of 30 malignant lesions 18 (58%) were primary tumors and 12 (41%) were secondary deposits. Of the benign tumors 1 (2.3%) was osteochondroma, 1 (2.3%) Osteoblastoma, 1 (2.3%) Chondroblastoma, 3 (7.1%) Giant cell tumor, 3 (7.1%) aneurysmal bone cyst, 1 (2.3%) Chondromyxoid fibroma, 1 (2.3%) Cemento – ossifying fibroma and 1 case (2.3%) Giant cell reparative granuloma.

Of the malignant bone tumors 5 (11.9%) were Osteo Sarcomas 4 were (9.5%) Chondro Sarcomas 6 were (14.2%) Ewings Sarcomas 2 (4.7%) were synovial Sarcomas, 1(2.3%) multiple myeloma and 12 (28.5%) were secondaries.

Aspiration failed to yield sufficient cellularity in cases of Osteoblastoma, Chondromyxoid fibroma, one case of Osteosarcoma and one case of Aneurysmal bone cyst.

With detailed clinical data, radiographical data and analysis FNAC can be accurate in most of the lesions.

Diagnostic accuracy of FNAC can be reached in cases of metastatic bone tumors.

FNAC can be of great help in differentiating between primary and secondary bone tumors.

FNAC can be dependable screening procedure in differentiating between the infective and neoplastic conditions of the bone.

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